INSTRUCTIONS: Do all work on the “work-sheets” that I supply. Do no more than two (2) problems per page. Box your final answer to each question. Circle important “sub-answers.” Draw a horizontal line between each problem. Do not… repeat – do not!!! (a) write anything except the page numbers in the top margin; (b) write anything whatsoever in the left margin; (c) write anything whatsoever on the back of any page, including this.

Points will be deducted for each instruction violation !!!

#6/9. Use Calculus to find the coordinates of the point on the line $L: 3x + 4y = 12$ that is closest to the point $P(6, 2)$. I suggest that you “minimize” the square of the distance function taken from an arbitrary point $(x, y)$ on the line $L$ to the point $P$. Then use the Second Derivative Test to “prove” that this is in fact the “closest” point.

#7/9. Find the dimensions of the rectangle of largest area that can be inscribed in an isosceles triangle of base 10 m and height 10 m, if one side of the rectangle lies on the base of the triangle.

Here are some helpful hints for this problem:

The equation of the right side of the triangle is $L_1: 2x + y = 10$.

The equation of the left side of the triangle is $L_2: 2x - y = -10$. (But you don’t really need to know $L_2$ in order to solve the problem.)

The length of the rectangle is $2x$. And the height of the rectangle is $h = y$.

#8/9. Find TMGA (The Most General Antiderivative)

[A] $f(x) = 4 + x^2 - 5x^3$  

[B] $g(\theta) = \sec(\theta)(\tan(\theta) - \sec(\theta))$

#9/9. Given that the graph of $f$ passes through the point $P(-1,3)$ and that the slope of its tangent line at $(x, f(x))$ is $3x^2 - 4x$, find $f(-2)$.

#BONUS: Find the point $P(x, y)$ on the graph of the parabola given by $y = 4 - x^2$ which is closest to the point $Q(3,4)$. Be sure to verify that it is the closest point.